# Asphalt Cement

# Introduction

- In HMA, asphalt functions as a waterproof, thermoplastic, viscoelastic adhesive
- By weight, asphalt generally accounts for between 4 and 8 percent of HMA and makes up about 25 – 30 percent of the cost of an HMA pavement

**Asphalt Physical Properties**

1. Durability.
    - Durability is a measure of how asphalt binder physical properties change with age. Sometimes it is called age hardening.
    - In general, as an asphalt binder ages, its viscosity increases and it becomes more stiff and brittle.
2. Rheology.
    - Rheology is the study of deformation and flow of matter.
    - Deformation and flow of the asphalt binder in HMA is important in HMA pavement performance.
    - HMA pavements that deform and flow too much may be susceptible to rutting and bleeding.
    - HMA pavements that are too stiff may be susceptible to fatigue cracking.
    - HMA pavement deformation is closely related to asphalt binder rheology.
    - Rheological properties of asphalt binder vary with temperature, so rheological characterization involves two key considerations.
        - First, to fully characterize an asphalt binder, its rheological properties must be examined over the range of temperatures that it may encounter during its life.
        - Second, to compare different asphalt binders, their rheological properties must be measured at some common reference temperature.
3. Safety.
    - Asphalt cement like most other materials, volatilizes (gives off vapor) when heated.
    - At extremely high temperatures (well above those experienced in the manufacture and construction of HMA), asphalt cement can release enough vapor to increase the volatile concentration immediately above the asphalt cement to a point where it will ignite (flash) when exposed to a spark or open flame. This is called the flash point.
    - For safety reasons, the flash point of asphalt cement is tested and controlled.
4. Purity.
    - Asphalt cement, as used in HMA paving, should consist of almost pure bitumen.
    - Impurities are not active cementing constituents and may be detrimental to asphalt performance

# Specific Gravity of Asphalt Cement

- Because the specific gravity of asphalt binders change with temperature, specific gravity tests are useful in making volume corrections based on temperature.
- The specific gravity at 15.6° C (60° F) is commonly used when buying/selling asphalt cements.
- A typical specific gravity for asphalt for Riyadh refinery asphalt is around 1.026.
- Almost as same as specific gravity for fine aggregate.

- Calculate the specific gravity to the nearest 0.001 as follows:

$$\gamma_a = \frac{C - A}{(B - A) - (D - C)}$$

Where:

$\gamma_a$ = Specific Gravity of asphalt.

A = Weight of pycnometer plus stopper.

B = Weight of pycnometer filled with water.

C = Weight of pycnometer partially filled with asphalt, and

D = Weight of pycnometer plus asphalt plus water.

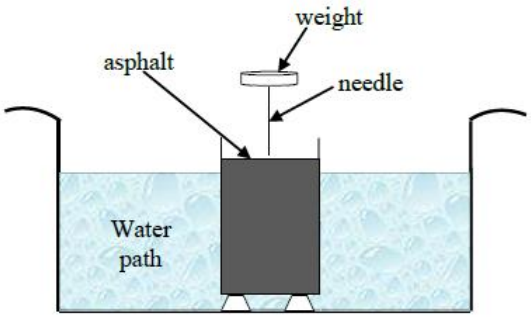
- Calculate density to the nearest 0.001 as follows:

$$\rho = \gamma_a \times \rho w$$

Where: $\rho w$ = Density of water at test temperature 25°C = 0.9971 g/cm3

# Penetration Test

- Consistency tests:
    - @ Normal and cold temperature, use penetration test.
    - @ Hot temperature, use viscosity test.
    - @ Warm temperature, use softening point.




- @ 0° C:

  Total weight = 200 gm for 5 sec.

  150 gm weight + 50 gm needle.

- @ 25° C:

  Total weight = 100 gm for 5 sec.

  50 gm weight + 50 gm needle.

- Penetration is measured in 0.1 mm unit

  If the reading is 60, ➔ penetration is 6 mm.